Ice Cold

Today you will be investigating the interaction of ice with two different forms of salt, and you will be asked to decide which form of salt, if either, is more effective for melting ice. During this activity you will work with a partner (or possibly two partners). However, you **must** keep your own individual lab notes because after you finish you will work **independently** to write an article about your experiment.

The Problem

In winter, sidewalks and front steps can become dangerously slippery when they are coated with ice. People often spread salt on steps and walks to help melt the ice.

Some people use ordinary table salt to prevent accidents on icy walks, while other people use rock salt. Does one work better than the other?

Your Task

Today you and your partner will design and conduct an experiment to investigate what happens when salt and ice come together and to determine if one form of salt (table salt or rock salt) is better for melting ice on steps and sidewalks.

You have been provided with the following materials and equipment:

Table salt (approximately 60g)	**Paper cups(2)**
Rock salt (approximately 60g)	**Plastic spoons (2)**
Ice cubes (approximately 500g)	**Thermometers (2)**
Tap water	**Weighing paper (2 sheets)**
Graduated cylinder	**Access to a balance**
Beakers (2)	**Safety equipment**
Paper towels for cleanup	**Access to a calculator**
Access to a clock or watch with a second hand	

Steps to Follow

1. In your own words, state the problem you are going to investigate, and write your statement of the problem on the page provided.

There are several ways to investigate this problem. If you decide to determine the temperature of the ice, mix **plenty** of ice cubes with a very small amount of water in a beaker. Then, measure the temperature of the ice water.* In order to get an accurate measurement, the bulb of the thermometer should be immersed in water at the bottom of the beaker. **Caution: Do not use a thermometer to stir the ice and water mixture.**

2. Design an experiment to solve the problem. Write your experimental design on the page provided. Show your design to your teacher before you begin your experiment.

3. After receiving approval from your teacher, work with your partner to carry out your experiment. Your teacher's approval does not necessarily mean that your teacher thinks your experiment is well designed. It simply means that in your teacher's judgment, your experiment is not dangerous or likely to cause an unnecessary mess.

4. While conducting your experiment, take notes on the pages provided. Space is also provided for charts, tables or graphs. Your notes will **not** be scored, but they will be helpful to you later as you work independently to write about your experiment and the results. You **must** keep your own notes because you will not work with your partner when you write your article. Later, you will work independently to write about your investigation in the form of a newspaper article that tells Connecticut citizens which type of salt is better for melting ice on steps and sidewalks. Turn the page and take a few minutes to read "Directions for Writing Your Article."

When you have finished your experiments, your teacher will give you instructions for clean-up procedures, including proper disposal of all materials.

(Students are provided with four blank pages for their notes.)

* The temperature of the ice water mixture will approximate the temperature of the ice.

Directions for Writing Your Article

You will have approximately 30 minutes to summarize your experiment(s) and the results in the form of a newspaper article that tells Connecticut citizens which type of salt, if either, is better for melting ice on steps and sidewalks. You may use the lab notes you took while working with your partner. You may wish to write a first draft of your article on scratch paper, but your final copy **must** be written on the following pages in this booklet. Space for charts, tables or graphs is provided.

Your article should include the following:

- **A clear statement of the problem** you investigated. A well-stated problem includes a clear identification of the independent and dependent variables that were studied.

- **A description of the experiment(s)** you carried out. A well-designed experiment should match the statement of the problem, control for important variables, and be clear and complete enough so that someone else could easily replicate or repeat the experiment. A control should be included when appropriate.

- **The results of your experiment(s).** All data should be accurate, complete and organized in charts or graphs as needed. All charts and graphs should be properly labeled.

- **Your conclusions from the experiment(s).** All conclusions should be related to your original statement of the problem and fully supported by data.

- **Comments about how valid you think your conclusions are.** In other words, how much confidence do you have that your results are accurate? In order for a conclusion to be valid, it must be fully supported by data and be the result of a well-designed and controlled experiment. Any factors that contribute to a lack of confidence in the results should be discussed.

(Students are provided with four blank pages for their report.)

Ice Cold Experimentation Questions

A class of students wanted to answer the question: Which is better for melting ice—ordinary table salt or rock salt? One group of lab partners filled three identical beakers with ice and water. Next, they added table salt to the first beaker, rock salt to the second beaker, and nothing to the third beaker. Then they used thermometers to measure the temperature in each beaker. The table below shows their results.

Contents of Beaker	Temperature After 5 Minutes
Ice water and table salt	-7ºC
Ice water and rock salt	-12ºC
Ice water without salt	0ºC

1. Why did this group bother to check the temperature of a beaker of ice water that had **no** salt added to it?

2. Do you have enough information to replicate this group's experiment? If you think you do, tell what information you have. If you think you do not, tell what other information you would need.

A second group of lab partners in the same class approached the problem differently. They put 10 ice cubes into beaker #1 and 10 ice cubes into beaker #2. Then they sprinkled one scoopful of table salt onto the ice in beaker #1 and one scoopful of rock salt onto the ice in beaker #2. They did not measure the temperature of the contents of the two beakers, but after 2 minutes they poured off the melted water and then weighed the two beakers and their contents.

They obtained the following results.

Mass of Beaker #1 and Contents	**Mass of Beaker #2 and Contents**
255 g	250 g

3. What valid conclusions can you draw from this group's experiment and results? Explain fully.

4. What, if anything, could this group have done to improve their experiment? Explain fully.